

How and why are the  
genes of organisms  
manipulated?

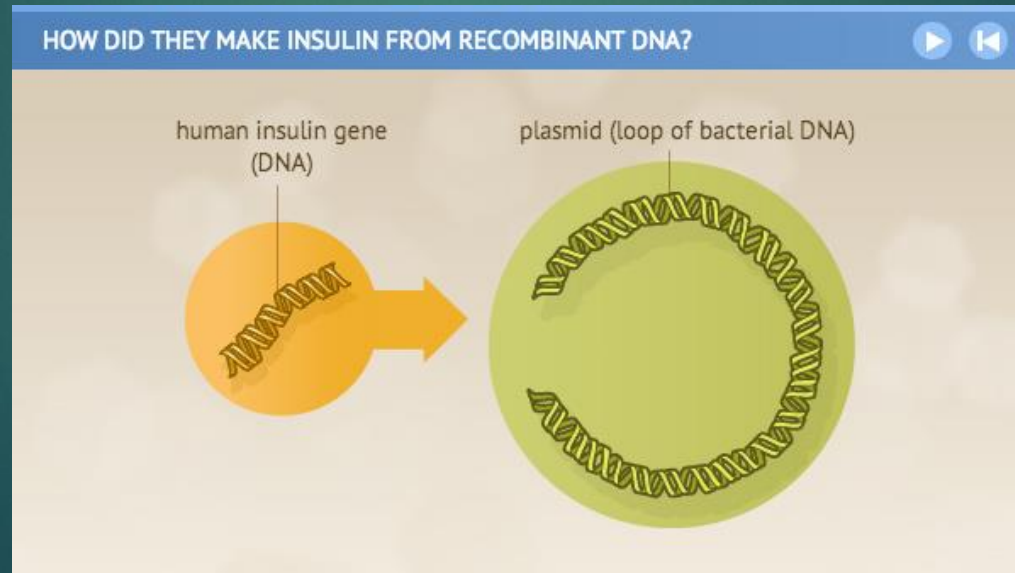


**DNA of a living cell can be copied, modified, and inserted into another organism.**

- **Biotechnology:** the use of technology and organisms to produce useful products
- **Cloning:** a process that produces identical copies of genes, cells, or organisms

# Gene Cloning

- **Gene cloning:** manipulating DNA to produce multiple copies of a gene or another segment of DNA in foreign cells
- Gene cloning is used to mass produce proteins (i.e., insulin).



# Transgenic Organisms

- **Genetic Engineering**

- the process of specifically altering the genetic make up of an organism

- **Transgenic organisms:** organisms that have foreign DNA from a different species inserted into them

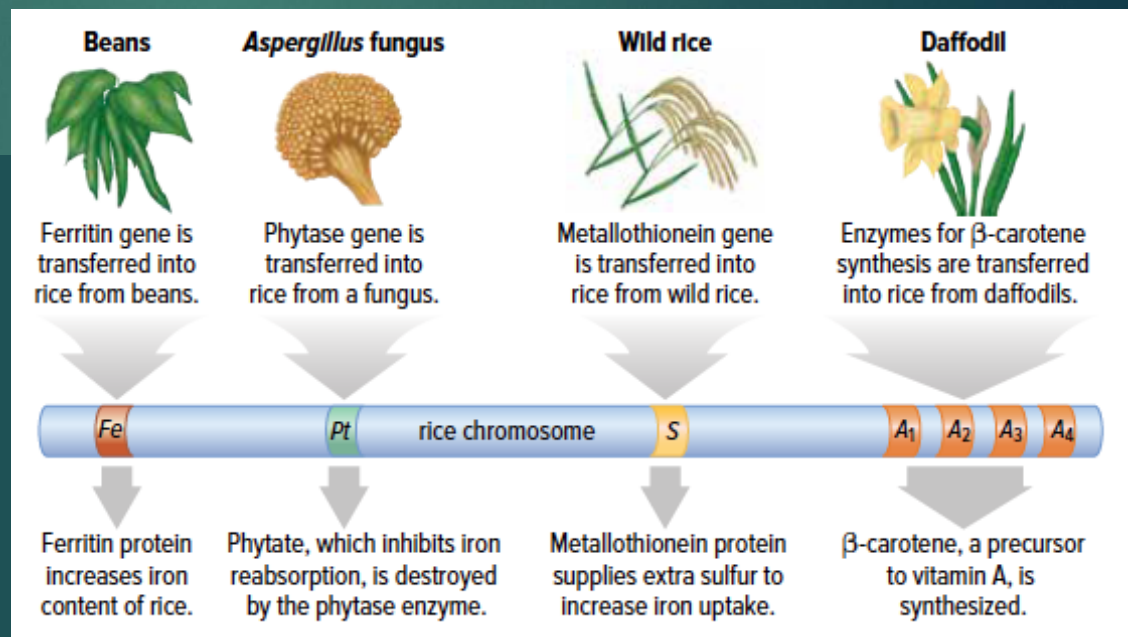
- These are types of *genetically modified organisms (GMOs)*.
- Transgenic crops have been genetically modified to be resistant to herbicides, pests, fungus, and viruses.



# Transgenic Plants: Golden Rice

- ▶ In developing countries, rice is a main staple food
- ▶ Golden rice has been genetically modified with genes from four different plants.
- ▶ It has increased iron and vitamin A content to help reduce malnutrition.

Figure 1.35: This transgenic product, golden rice, contains four different foreign genes. Three of these genes come from other plants, and one comes from a fungus. Inferring: How could the development of such a disease-resistant plant be economically advantageous?

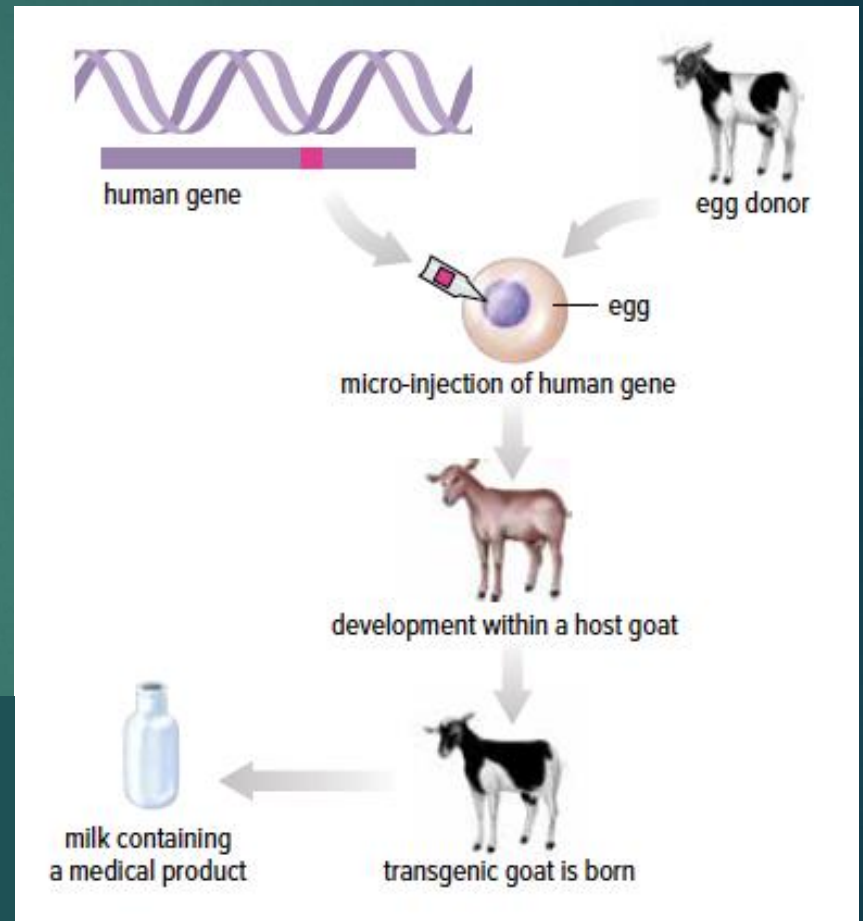




# Applications of Transgenic Animals

- ▶ Transgenic goats are used to produce proteins, human growth hormones, and anti-clotting factors in their milk.

Figure 1.36: Genetic engineering can create transgenic animals that secrete human proteins or other substances in their milk.



## Concept 2: DNA technology has many uses.

- ▶ DNA profile determines specific sequences of DNA unique to a person.
- ▶ It is used to see if a person's DNA is at a crime scene.
- ▶ It can be used to determine if people are related to each other.



Figure 1.37: DNA profiles are used by law enforcement to identify or eliminate perpetrators of crimes.

# Reproductive Technologies

Two biotechnology advancements that help people conceive children:

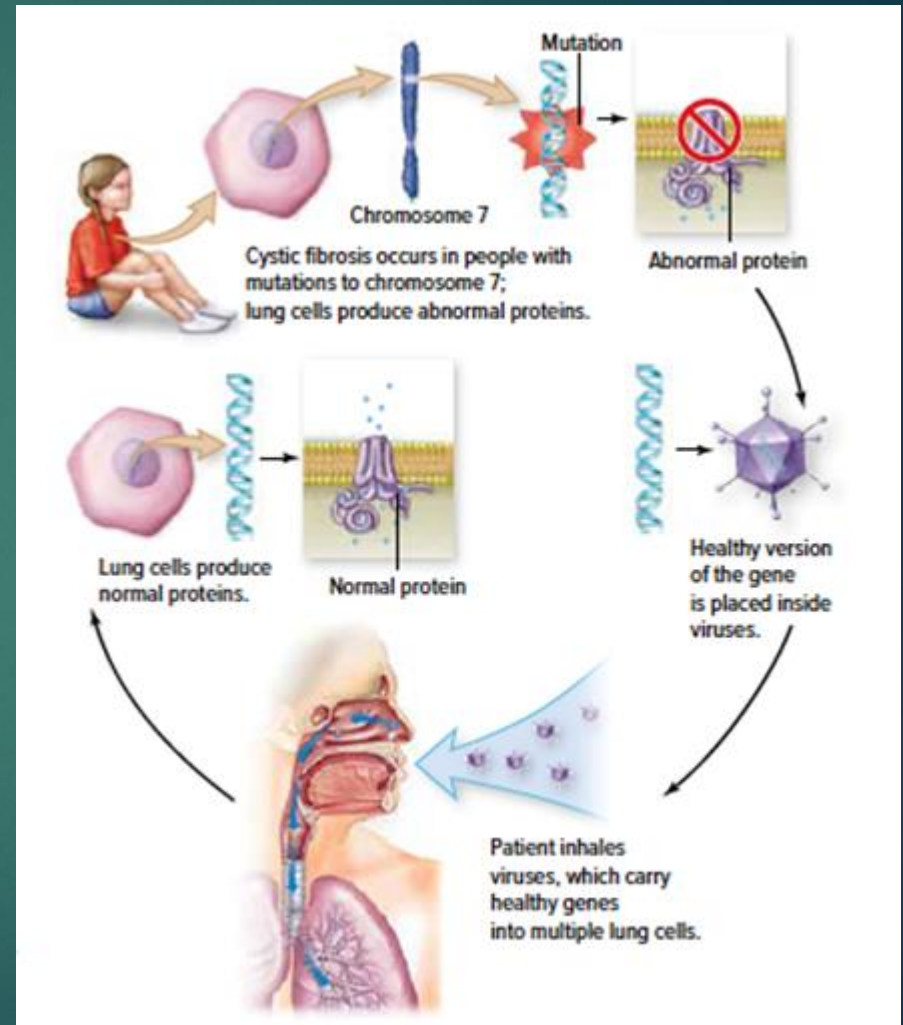
- ▶ **Artificial insemination:** a process that involves collecting and concentrating sperm, and then placing it in the female's uterus
- ▶ **In vitro fertilization (IVF):** a process that results in a female's eggs being fertilized by sperm outside of the body





# Gene Therapy

- ▶ **Gene therapy:** an experimental treatment to cure genetic disorders that involves inserting a healthy, normal form of a gene into the cells of tissues that are affected by a disorder



# Food Crops and Testing for Viruses

- ▶ Biotechnology can be used to reduce testing time for the presence of viruses in crops for export.



# Invasive Species and Forests of British Columbia

- **Invasive species:** a species that is not native to an ecosystem and can cause harm to it
  - e.g., Asian long-horned beetle, Asian gypsy moth
  - Detection of invasive species can be done by extracting DNA sample from insect eggs from exported lumber.

